ARTICLE

Size and Age-Sex Distribution of Pediatric Practice

A Study From Pediatric Research in Office Settings

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Objectives: To estimate (1) the average number of patients per practitioner in Pediatric Research in Office Settings, the national practice-based research network of the American Academy of Pediatrics; (2) the total number of active patients cared for in the network; and (3) the age-sex distribution of patients seen in pediatric practice.

Setting: Eighty-nine practices in 31 states with 373 Pediatric Research in Office Settings practitioners (59% of Pediatric Research in Office Settings members).

Methods: Practices were asked to enumerate the number of patients visiting the practice during the 2-year period from January 1, 1991, through December 31, 1992. Patients making multiple visits were counted only once, resulting in a patient count rather than a visit count. Age-sex registers were completed using computer billing records or medical record sampling.

Results: Study participants cared for 529 513 active patients (50.7% male). Each practitioner cared for an average of 1546 patients. The number of patients per practitioner was significantly higher in less-populated areas and in solo practices. Children aged 12 years and younger comprised 81% of the patients seen by Pediatric Research in Office Settings practitioners, and more than half of the children were aged 6 years or younger. Before age 5 years, boys accounted for a slightly, but significantly, higher number of patients, whereas after age 14 years, girls comprised a significantly larger proportion of patients.

Conclusions: The average number of 1546 patients per practitioner derived from these private practice data is in line with health maintenance organization–based estimates. Pediatric practitioners predominantly serve younger children. These data provide the only current national estimates of the size and age-sex distribution of independent pediatric practices, and can help pediatricians and health service researchers plan for the future provision of health care to children.

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EMPIRICAL DATA on the size of pediatricians' practices—ie, the number of children cared for by an individual pediatrician—are lacking. (Size of practice is defined here as the number of children cared for by an individual pediatrician.) A recent report by the American Academy of Pediatrics (AAP) Committee on Careers and Opportunities cited previously unpublished empirical data from 7 health maintenance organization (HMO) sources.[1] These estimates of the number of patients per pediatrician varied from a low of 885:1 to a high of 1750:1. More recent data from a group of 50 staff- and group-model HMOs arrived at a figure of 1795:1.[2] Health maintenance organization–based ratio estimates may, however, be artificially low. This may occur because children seen in HMOs have higher visit rates than children seen in fee-for-service settings,[3] which may require HMOs to staff more pediatricians to care for equivalent numbers of patients. With respect to non-HMO settings, there are no recent published studies.

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Similarly lacking are recent data on the age distribution of patients seen by office-based pediatricians. Studies based on US physician visit data from the 1970s[4] indicated that children comprised a smaller proportion of visits to pediatricians as they grew older and that adolescents accounted for a relatively small proportion of pediatric patients. However, the steady increase in the US pediatrician-child population ratio[5] occurring since that time could have resulted in an increased number of visits to pediatricians by older children and adolescents. Unfortunately, there was no information to support or refute this hypothesis.

MATERIALS AND METHODS

SAMPLE

In 1993, the PROS network consisted of 155 pediatric practices with 632 practitioners in 31 states. Ninety-one percent of PROS practitioners were pediatricians and the remaining 9% were nurse practitioners. When compared with random samples of AAP general pediatricians, PROS pediatricians were similar in age and sex but were more likely to practice in suburban areas and in group practices.[11] An age-sex register protocol and data collection materials were mailed to all practices in January 1993 and follow-up on data collection was conducted periodically for 1 year.

QUESTIONNAIRE

The contact practitioner was asked to complete a brief questionnaire describing the practice. Specific questions included the number and type of practitioners, information on the population density in the practice area, and practice billing and medical record routines. No information was collected on whether practitioners were full time or part time, and no differentiation was made between type of practitioner (eg, nurse practitioner vs pediatrician).

AGE-SEX REGISTER

Practices were asked to enumerate the number of patients visiting the practice during the 2-year period from January 1, 1991, through December 31, 1992. Patients making multiple visits were counted only once, resulting in a patient count rather than a visit count. The unit of data collection for the study was the entire practice, not the practitioner.

Practices were instructed to use 1 of 2 methods of data collection: the computer billing method (CBM) or the medical record sampling method (MSM). To count a patient as active or visiting the practice, both methods required documentation of the physical presence of the patient in the office. No telephone contacts were included.

For practices to participate in the CBM, it was necessary for the office computer or billing service to compile a listing of the number of patients who were seen from January 1, 1991, through December 31, 1992, by year of birth and sex. This was only possible if the CBM could generate a unique identifier for each patient.

Practices incapable of employing the CBM used the MSM. If the practice kept individual patient records, it was instructed to sample every fifth medical record and record data under the appropriate year of birth and sex, provided the patient had been seen in the past 2 years. If the practice used family medical records, every fifth medical record was used and data were recorded on a form under the appropriate year of birth and sex for each patient in the family that had been seen in the past 2 years. The patient counts in the MSM were multiplied by 5 to calculate the total number of patients per practice.

Six practices with 4 or more practitioners volunteered to complete both methods. In 5 of these 6 practices, the CBM yielded higher patient counts (–13%, +11%, +16%, +17%, +26%, and +29%). The small number of practices that completed both methods precludes statistical analysis. In the overall enumeration for the network, the CBM results from these practices were used, since most practices in the study (61%) had used this method and the counts represented an actual total rather than a calculated

The development and enumeration of an age-sex register is one way to determine empirically the size and age-sex distribution of any medical practice. This method, which has been used for several decades, involves counting, within age and sex categories, the patients who have visited a practice within a given period.[6] The assumption is made that an individual who has visited the practice within a given time frame is an active patient. The time frame used for defining an active patient can vary; however, a common standard is 2 years.[7,8]

Accurately determining the number of patients served by a practice or practitioner (often referred to as "defining the denominator") is not necessarily a straightforward process.[9,10] Difficulties include the mobility of patients in US health care settings, different methods of record keeping, and not accounting for patients who do not visit the practice during a specified period. Despite these limitations, the age-sex register provides a practical way to estimate the size and composition of primary care practice populations. Age-sex registers have been used extensively in family practice research,[7] but have not been used previously to assess pediatric practice populations.

During the early 1990s, Pediatric Research in Office Settings (PROS), Elk Grove Village, Ill, the national practice-based research network of the American Academy of Pediatrics, Elk Grove Village, decided to create an age-sex register for all practices in the network. This effort was made to meet many needs, including the need of the internal PROS network to know the age and sex distribution of network patients to plan future studies and develop incidence and prevalence data, and the need in practices for information to help allocate practice resources and assess the need for provision of local health services. Finally, results based on empirical data derived from private practice were expected to inform discussions of the pediatric workforce. The specific objectives of this study were to estimate (1) the average number of patients per practitioner in the network; (2) the total number of active patients cared for in the network; and (3) the age and sex distribution of patients seen in pediatric practice.

RESULTS

Eighty-nine practices in 31 states with 373 PROS practitioners submitted usable data (59% response rate). Data were judged as unusable if they were incomplete or unreadable. Demographic data were available on 39 PROS practices that did not complete an age-sex register. Participating and nonparticipating practices were compared on practice size (solo and 2-physician practices vs group practices), census region, reported proportion of Medicaid patients in the practice, and use of computers in practice. Two-tailed *t* tests and analysis of variance with Bon-

estimate. For all participating practices, results from the MSM and CBM were totaled and analyzed, as has been previously conducted with age-sex registers.[7]

DATA ANALYSIS

Frequency distributions for the network were calculated by age and sex. Since a primary study objective was to determine the total patient count for the PROS network, this count was obtained by multiplying the number of active patients in each practice by the proportion of practitioners who were members of PROS. This proportion was generally high, with 54% of practices having all of their practitioners enrolled in PROS.

Because estimating the average number of patients per practitioner seen in the network was an objective of the study, but (1) part-time status of practitioners was not identified through the questionnaire and some of the practitioners undoubtedly worked part time and (2) an estimated 9% of practitioners were nurse practitioners rather than pediatricians, adjustments were made in calculating the number of patients per practitioner.

The patient–full-time-equivalent practitioner ratio was generated by dividing the total numbers of patients enumerated in the age-sex register by the number of full-time-equivalent practitioners comprising the practitioner sample. The full-time-equivalent practitioner total was based on the sum of the following: (1) an estimate of part-time pediatricians in the sample (based on total numbers of practitioners in the sample, multiplied by 91%, the network estimate of PROS practitioners who are pediatricians, and multiplied again by 8%, the national estimate for part-time pediatricians, as yielded from a recent AAP Periodic Survey[12]), multiplied by 0.5, on the assumption that part-time pediatricians work half-time, on average; (2) an estimate of part-time nurse practitioners (based on total numbers of practitioners in the sample, multiplied by 9%, the network estimate of PROS practitioners who are nurse practitioners, and multiplied again by 20%, the national estimate of part-time nurse practitioners[13]), multiplied by 0.5, again on the assumption that part-time pediatricians work half-time, on average; (3) estimate of full-time pediatricians (based on total numbers of practitioners in the sample, multiplied by 91%, the network estimate of PROS practitioners who are pediatricians, and multiplied again by 92%, the estimated number of full-time pediatricians); and (4) estimate of full-time nurse practitioners (based on total numbers of practitioners in the sample, multiplied by 9%, the network estimate of PROS practitioners who are nurse practitioners, and multiplied again by 80%, the estimated number of full-time practitioners). *Note*: This procedure is equivalent to saying that the number of full-time practitioners is equal to the adjustment factor 0.9546 multiplied by the total number of practitioners.

Full-time-equivalent Practitioner/Patient Ratio = [Total Number of Patients Seen/(A + B + C + D)]

Where A = (Total Number of Practitioners in the Sample) × (Percentage of Pediatricians) × (Percentage of Part-time Pediatricians) × (Proportion of Time Worked by Part-time Pediatricians); B = (Total Number of Practitioners in the Sample) × (Percentage of Nurse Practitioners) × (Percentage of Part-time Nurse Practitioners) × (Proportion of Time Worked by Part-time Nurse Practitioners); C = (Total Number of Practitioners in the Sample) × (Percentage of Pediatricians) × (Percentage of Full-time Pediatricians); D = (Total Number of Practitioners in the Sample) × (Percentage of Nurse Practitioners) × (Percentage of Full-time Nurse Practitioners)

ferroni correction for multiple comparisons revealed no significant differences between these practices.

The sample of 89 practices completing an age-sex register consisted of 12 solo practitioners (13.5%), 19 small group practices (2-3 practitioners) (21.3%), and 58 large group practices (65.2%). Seventy-three percent of participants reported the population of the county or metropolitan area of their practice as greater than 100 000. Practices' self-reported estimates of payment sources were 40% fee-for-service insurance, 15% capitated insurance, 16% Medicaid, 25% self-pay, and 4% other. Overall, 61% of practices used the CBM and 39% used the MSM.

The number of active patients (defined as having been seen at least once during the last 2 years) cared for by study participants was 529 513. After adjusting for the number of full-time equivalent pediatricians and nurse practitioners, each practitioner cared for an average of 1546 patients (SD, 827; median, 1320; minimum, 198; and maximum, 4025).

The average numbers of patients per practitioner were analyzed by census region, population of region, and proportion of Medicaid patients in the practice, using 2-tailed *t* tests and analysis of variance with Bonferroni correction for multiple comparisons. Because the distribution of patients per practitioner was abnormal, these data were transformed with the square root. Since the results of analyses of transformed and untransformed distributions did not differ, the untransformed means of patients per practitioner and *t* tests, calculated by using transformed data, are presented in **Table 1**. The number of patients per practitioner was higher in less-populated areas (P =.01) and in solo practices when compared with group practices of 4 or more practitioners (P=.05). There were no significant differences by region of the country or by reported percentage of Medicaid patients.

Table 2 gives actual patient counts by age and sex. The percentage by age is shown in the **Figure**. Younger children account for the overwhelming majority of patients seen in these pediatric practices. Children aged 12 years and younger comprised 81% of the patients seen by PROS practitioners. More than half of the children seen were 6 years of age or younger. Sex differences were also noted according to the age of the patient. Age categories were divided into 4 groups for calculation of the χ^2 statistic, including 0 to 4, 5 to 9, 10 to 14, and 15 to 21 years of age. Before age 5 years, boys accounted for a small, but significantly higher, number of patients seen (χ^2_4 = 40.76, $P<.05$). In contrast, after age 14 years, girls comprised a significantly larger proportion of patients (χ^2_6 = 41.38, $P<.05$). In later adolescence, female patients accounted for a majority, accounting for as high as 55% of the patients by age 21 years.

Table 1. Practice Characteristics and Patients per Practitioner

Practice Characteristic (No. of Practices)	Average No. of Patients per Practitioner
Population of the county or metropolitan area in which the practice is located*	
≤100 000 (24)	1915
>100 000 (65)	1410
Type of practice†	
Solo (12)	2097
2-3 practitioners (19)	1606
4 or more (58)	1412
Census region	
Northeast (33)	1299
North central (16)	1480
South (25)	1716
West (15)	1877
Estimated proportion of Medicaid patients in the practice	
0%-19% reported Medicaid (55)	1656
20%-100% Medicaid (25)	1440
Missing (9)	NA‡

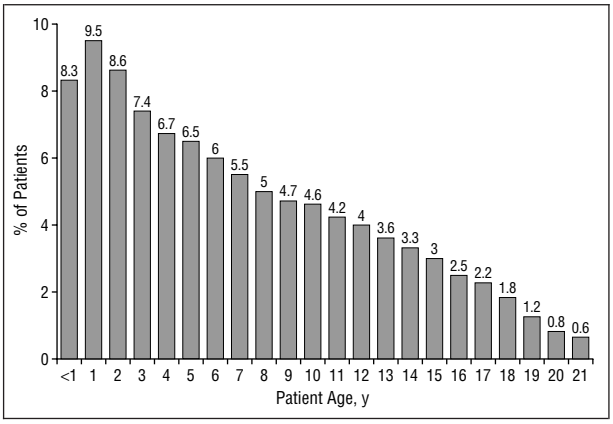
*P = *.01.*
†P = *.05; difference between solo and 4 or more practitioners.*
‡*NA indicates not applicable.*

Table 2. Patient Count and Percentage: Age and Sex

Age Group by Year of Birth (Age, y)	No. (%)		
	Male	Female	Total
0-4			
1992 (<1)	21 836 (50)	22 010 (50)	**43 846** (8.3)
1991 (1)	25 937 (52)	24 393 (48)	**50 330** (9.5)
1990 (2)	23 214 (51)	22 154 (49)	**45 368** (8.6)
1989 (3)	20 189 (52)	18 896 (48)	**39 085** (7.4)
1988 (4)	18 236 (52)	17 160 (48)	**35 396** (6.7)
5-9			
1987 (5)	17 524 (51)	16 665 (49)	**34 189** (6.5)
1986 (6)	16 254 (51)	15 819 (49)	**32 073** (6.0)
1985 (7)	14 873 (51)	14 266 (49)	**29 139** (5.5)
1984 (8)	13 390 (51)	13 024 (49)	**26 414** (5.0)
1983 (9)	12 905 (52)	12 112 (48)	**25 017** (4.7)
10-14			
1982 (10)	12 430 (51)	11 743 (49)	**24 173** (4.6)
1981 (11)	11 264 (51)	11 038 (49)	**22 302** (4.2)
1980 (12)	10 985 (52)	10 315 (48)	**21 300** (4.0)
1979 (13)	9758 (51)	9426 (49)	**19 184** (3.6)
1978 (14)	8805 (51)	8456 (49)	**17 261** (3.3)
15-21			
1977 (15)	7851 (50)	7982 (50)	**15 833** (3.0)
1976 (16)	6577 (47)	6949 (53)	**13 526** (2.5)
1975 (17)	5432 (48)	5989 (52)	**11 421** (2.2)
1974 (18)	4553 (47)	5035 (53)	**9588** (1.8)
1973 (19)	3117 (47)	3511 (53)	**6628** (1.2)
1972 (20)	2011 (46)	2352 (54)	**4363** (0.8)
1971 (21)	1379 (45)	1698 (55)	**3077** (0.6)

COMMENT

The total number of active patients in the PROS network estimated from these early 1990s data was slightly more than 500 000 children. The PROS figure of approximately 1500 patients per pediatric practitioner, where the number of patients is based on visit data, is in line with HMO-derived estimates of between 1200 and 1800 patients per physician, where the number of patients are derived from enrollee data.[1,2] Since only 1 of the 89 practices in this study was a staff-model HMO, the 1500 pediatric patients per practitioner figure is likely valid for non-HMO settings. This figure should provide a useful guide for health planners and practices that are considering adding additional practitioners.



Percentage of patients seen by years of age.

The factors associated with higher numbers of patients per practitioner—rural location and smaller number of pediatricians per practice—are intriguing. Fewer practitioners work in rural areas and it is very likely that modern transportation allows them to draw from large outlying areas to overcome the lower population density. With respect to practice size, it is very possible that the solo practices and smaller group practices are more mature practices, with large numbers of older, infrequently visiting children accounting for their increased capacity. These speculations cannot, however, be verified from our sample.

Based on the patients per practitioner figure of 1546 derived from this study, it is likely that the current 1400 PROS network practitioners serve approximately 2 million US children. This growing PROS patient base should permit the network to undertake studies that might prove impossible in other research settings. Knowledge of the age distribution will help the network in planning studies of particular age groups (such as adolescents).

Study results on the age of patients seen by practitioners indicate that, despite the larger numbers of pediatricians per pediatrician-child population ratio that have occurred during the last 20 years,[5] the patient population seen by pediatricians declines steadily with advancing patient age. Even though practitioners in the study saw patients through age 20 years, a quarter of patients were younger than 3 years, and more than half were younger than 7 years. In contrast, patients aged 12 years and older comprised less than a quarter of practice patients. The limited data collected in this study do not allow for much speculation as to whether this phenomenon is more or less pronounced than it was 2 decades ago. It is certainly true that the definition of a practice patient used in this study (ie, seen for at least 1 visit in the last 2 years) would underestimate the true number

of older patients who might consider themselves patients of the practice but not have visited within the past 2 years. Even so, it is unlikely that this explains the overall pattern found in this study, especially since other research suggests that older children are more likely to be seen by other types of primary care physicians.[4] Previous comparisons of PROS pediatricians with random samples of AAP pediatricians have shown them to be similar in age, making it unlikely that the practitioners in this study were younger or had newer practices with a larger number of younger patients.

The slightly higher proportion of boys among patients younger than 5 years is puzzling and difficult to explain. The higher proportion of girls among patients aged 15 years and older could mean that female patients feel most comfortable remaining in the care of pediatricians, while male patients tend to move on to other sources of care. An alternative explanation is that the difference reflects the fact that visits to the practice form the basis of the counts in this study. It is known from other research[14] that adult women visit physicians more frequently than men. Therefore, it is possible that the higher proportion of girls in late adolescence reflects the beginning of a differential tendency for older girls to have more frequent health care visits, and thus be counted more frequently as a group in an age-sex register.

Anecdotal reports from study participants indicated that in practices with computerized billing, the CBM proved very easy to implement. We therefore suggest that practices may wish to generate their own age-sex registers on a periodic basis. This would permit tracking of practice size and changes in practice age distribution. In an era of increasing managed care, such information could inform management decisions and negotiations regarding capitation and also aid with clinical planning to improve practice efficiency.

This study has limitations that need to be emphasized. As discussed above, the technique of developing patient counts based on visits to a practice within the past 2 years may underestimate the number of older patients. In addition, the technique may overestimate the percentages of younger patients. This is because patients who are only seen once and are therefore not considered true patients but are still counted are more likely to be young, since young patients have more frequent health care visits. Nevertheless, the age-sex register is still an accurate representation of who visited the practices within a 2-year period.

Second, although we attempted to account for full- or part-time status of practitioners as described in the Data Analysis subsection of the Materials and Methods section, this method used national estimates, and it is unknown whether the sample of PROS practitioners actually corresponds to these estimates. Furthermore, our adjustment to these data did not consider both practice size and part-time status of practitioners. It is possible that larger practices have more part-time practitioners than smaller practices. If, in fact, there is a systematic overall increase or decrease in patient counts based on part-time status and practice size, this may influence our findings.

Third, it is conceivable that patient volume in PROS practices may be different than pediatric practices in general. As noted earlier, however, from a variety of standpoints, PROS practices are similar to other pediatric practices. We might therefore hypothesize that patient volume is similar, but no true comparative data are available.

Finally, 2 possible sampling limitations should be acknowledged. The MSM and CBM may not yield comparable results. Although a few practices used both methods to determine counts, this was not done enough to determine any meaningful patterns. We cannot say, therefore, whether either method consistently overestimates or underestimates patient counts. The potential exists for variation among practices in the methods of purging the medical records of patients who have transferred or moved, which may influence patient counts. Insufficient information on the particulars of purging records precluded refinement of the data in this area.

Within these limitations, however, we believe that these results contribute considerably to the very limited literature on pediatric practice size and composition. These data provide the only current national estimates of the size and age-sex composition of independent pediatric practices, which remain the most common form of pediatric practice. This study can help pediatricians and health services researchers understand the present demographics of pediatric practice and plan for the future delivery of health care to children.

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